The developmental behaviour of foals and its relevance to husbandry. Part 1: the first 3 months

The veterinary team frequently encounters foals as inpatients and during ambulatory duties, and thus play a key role in providing help and education to breeders. Having a good understanding of foal development from birth, weaning and beyond can have a significantly positive impact on the foal's future behaviour and quality of life. Equines behaving in a calm, safe manner is for the enjoyment of equestrian activities and is in the economic interests of those professionally involved. Successful management includes equipping the foal with a robust musculoskeletal system, healthy selective grazing behaviour, encouraging good social skills and safe behaviour around human handlers, all while promoting good quality of life for the young horse. This article is the first of two applying the research on foal behavioural development to good practice in the management and training of foals. This article covers the first 3 months of the foal's life, including socialisation and early handling and management of the foal, the second will cover the evidence surrounding weaning practices.

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Foals are commonly encountered as inpatients, either as the primary patient or where the dam is the primary patient (Harniman, 2021). Larger numbers of mares and foals are also seen by vets for preventative care or reproductive services. Veterinary professionals are highly regarded sources of reliable, evidence-based information and advice, and the aim of this article is to provide the most up-to-date research and its practical application. How foals are managed and handled affects their future behavioural responses. Getting foal handling right promotes future desirable behaviour and safeguards horse welfare (King et al, 2019). This article examines the development and husbandry of foals from birth to 3 months of age.

The developmental periods of the foal

Crowell-Davies (1986a) identified three developmental stages: the dependent period from birth to 3–4 weeks, the socialisation period from 2–3 months and the stabilisation period from 4 months onwards. Boy and Duncan (1979) also identified a pre-weaning period in the last month before natural weaning, where foals have another rapid shift in behaviour. The stabilisation period, the pre- and post-weaning periods and methods of weaning will be discussed in the second article.

Managing foals in the dependent period

Allow the mare to stay close to her foal and avoid bringing the foal to the teat

Foals restrained and brought to the teat for first suckling avoided human approach for two weeks and physical contact for a month (Henry et al, 2006). During the neonatal period, foals should be on their feet within the first hour after birth, nursing within 2 hours (and every 30 minutes approximately thereafter), and have passed the meconium within 3 hours. Provided these events run their normal course there should be no need to step in and handle the foal at this stage. Foal intake of colostrum is dependent on two factors: the foal's suckling activity and the mare's manufacture of colostrum.

When left alone, mares and foals stay within 5m of each other for the first week (Crowell-Davis, 1986b). Mares actively maintain a close distance to their foals during the first weeks to promote the foal's bond towards them, and this peaks at 2 weeks of age (Houpt, 2002). After this, mare-foal distances gradually increased (Crowell-Davis, 1986b; Houpt, 2002). Henry et al (2005) used gentle, positive handling of the mare during the first 5 days post-foaling, to familiarise foals with people. Protective mares need to be able to move between foal and the handler. While positive interactions with the mare are beneficial, this must not interfere with the mare-foal bond.

Keep a peaceful and quiet environment for the foal to rest in the morning and finish yard activities by 9pm

Foals need frequent rest, which takes up at least 32% of their time (Crowell-Davis, 1994, Zanker et al, 2021). Zanker et al (2021) used polysomnographic recording to measure foals' somnolence, REM sleep, slow wave sleep, light sleep and wakefulness during the first week. Foals were also filmed to monitor behaviour. The most wakeful and active behaviour occurred from 3–9pm, and more sleep occurred overnight. Stable staff started from 6am and there was an abrupt shift from predominately sleep behaviours to wakeful behaviours coinciding with this. Until the effects of circadian rhythm on wakefulness in foals can be established, Zanker et al (2021) advise performing yard duties in the later afternoon when foals are naturally more alert.

There is currently no research on the effects of noise from radios or machinery on the welfare of foals, but such potential disturbances should be carefully considered alongside yard duties to minimise disruption to sleep early in the day. It is conventional to provide one full muck out per 24 hours (usually in the morning) and to skip out, water, hay and feed at regular intervals throughout the day. Provided thorough mucking out occurs at least once in a 24-hour period, there is no other reason, other than convention, as to why it should be in the morning provided the box is at least quietly skipped out.

Feed orphan foals frequently throughout the day and night

Foals suckle frequently at all hours of the day and night, as this is crucial for their energy requirements (Zanker et al, 2021). Where foals are artificially suckled in groups, there is a temporary disturbance of behaviour, such as longer durations of standing, more aggressive behaviour and cross suckling, and less suckling when compared to naturally suckled peers (Tateo et al, 2013). These disturbances typically reduce after 10 days.

Have positive interactions with the mare

Scratching at the withers helps to lower heart rate (Feh and de Mazieres, 1993) and is likely to be relaxing (Thorbergson et al, 2016). Henry et al (2005) demonstrated that gentle grooming and hand feeding for 15 minutes a day for the first 5 days post-birth made people more attractive to foals when tested in stationary human and approach tests at 15 days, 30–35 days and 11–13 months of age.

Avoid inducing fear behaviour

Foals with a more nervous temperament will approach their dams more quickly and spend less time exploring novel items (Christensen et al, 2020). Some foals are inherently more fearful than others, and fear behaviour has been demonstrated to persist (Lansade et al, 2008, Diugan et al, 2014, Christensen et al, 2020).

Not all foals are fearful; others are sufficiently confident to investigate and quickly learn to seek human attention. Give attention that is contingent on calm behaviour from the foal. Scratch and fuss them when they are standing quietly - not mouthing or pushing. Keep the duration short and finite to avoid provoking excitable and potentially dangerous play behaviour as this can invite physical punishment, a negative experience we are trying to avoid.

The foal should be present whenever possible during any teasing and covering, as being left in the stable while the mare is removed causes distress and increased risk of injury. If this is not possible, a person remaining with the foal reduces the intensity of stress related vocalisations and locomotor behaviour (McGee and Smith, 2004).

Box 1. International Society for Equitation Sciences training principles

- Regard for human and horse safety
- Regard for the nature of horses
- Regard for the horses' mental and sensory abilities
- Regard for current emotional states
- Correct use of habituation, desensitisation and calming methods
- Correct use of operant conditioning
- Correct use of classical conditioning
- Correct use of shaping
- Correct use of signals and cues
- Regard for self-carriage

Consider early training of the foal very carefully

Foals might not find handling by humans positive (Henry et al, 2006). Only a stationary person present in the neonatal period was found to have a weak positive influence on the foals' attraction to humans 15 days later, compared to bringing the foal to the teat or restraining the foal to stroke it (Henry et al, 2006). Unless essential, for example in the case of orthopaedic problems, injury or infection, postpone early handling in favour of using the International Society for Equitation Sciences' training principles (*Box 1*) when the foal enters the socialisation period (King et al, 2019). Should early handling be necessary, handle the foal gently and release them at the point when they are calm. Many foals enjoy being scratched over the withers and this can be used to induce calmer behaviour and reinforce desired behaviour, reducing the need for physical restraint.

It has been demonstarted that removal of the foal from the mare for handling in the first hour post-birth resulted in an insecure attachment to the mare (Henry et al, 2009), whereby foals developed a strong dependency on the mare and played less than their peers. Decreased social competency, increased aggressive behaviour and social withdrawal also persisted to at least adolescence (Henry et al, 2009). In another early handling study, mares of handled foals were less active in maintaining proximity to their foals by the time the foals reached 5 weeks of age, compared to dams of unhandled controls (Søndergaard and Jago, 2010). There is very little research on early handling and the mare-foal relationship, and more is needed.

Retention of early learning, ability to cope with social isolation and novelty has had mixed results when foals are tested later. While Spiers et al (2004) found foals handled for 45–60 minutes 10 minutes post-birth and again 24 hours later were more cooperative with hoof handling up to 3 months of age. These foals were no different from unhandled controls for ease of general handling and vaccination. In similar early training, Simpson (2002) found that handled foals were generally calmer, more likely to approach people and easier to handle than unhandled controls, but Williams et al (2002) found that foals became gradually less tractable, and the effects of training did not persist beyond 3 months. This was also the case

for Lansade et al (2007) who also tested reactions to social isolation and novelty, even when the procedure was extended over 14 consecutive days.

Keep mares and foals at pasture

Play behaviour is spontaneous and energetic, and at this age is directed at and around the dam and towards natural objects found in the environment (Crowell-Davis et al, 1987). Spontaneous play behaviour promotes musculoskeletal development (Rogers and Dittmer, 2019). Locomotor play in the first month is the most energetic in terms of speed attained and distance travelled (Kurvers et al, 2006). When foals are stabled and let out for compensatory locomotor play, the amount of play is insufficient to make up the deficit compared to play by foals kept entirely outside (Kurvers et al, 2006).

Where local conditions restrict year-round turnout of mares and foals, any turnout is better than no turnout. Consider encouraging 'outside the box' thinking. Breeding is a considerable investment in horses intended to be fit for athletic endeavour and as such, they require robust musculoskeletal systems. Established groups can be kept successfully in large barns and 'active stables' – large purpose-designed yards with suitable substrate for locomotor play, as well as excellent provision of shelter, such as Schauer active horse systems.

Pasture is also important for early grazing behaviour. From days 0 to 40, foals explore a wide variety of plants and are not selective (Bolzan et al, 2020). They will not avoid toxic plants.

Keep mares and foals in socially compatible groups

Foals in the dependent period don't tend to interact with other horses until the 3rd or 4th week, but being in a group prepares the mare and foal for the socialisation period that follows. Where mares have access to ample resources and are in good condition, maternal rank has no effect on most social behaviour. Only foals of high-ranking mares did not receive aggression during the first month (Heitor and Vicente, 2008). Adults tend to direct mild aggressive behaviour towards foals that are not their own. Provided horses are socially compatible, which is more likely in an established group, the risk of injury to the foals remains low (Sigurnsdottir and Haraldsen, 2019).

Repeated re-grouping of horses risks increased aggressive behaviour (Christensen et al, 2011), so mares are best kept in stable groups before breeding. When introductions are made, they should be done gradually over several days to weeks. Best practise is to place them in an adjacent field or paddock first. The author prefers to have a 4m wide gap between enclosures to prevent fence injuries from striking or kicking. Once each party is consistently settled with the other, introduce another sociable mare and her foal, or a suitable friendly gelding, and allow them to become established. Then place the new sub-group into the intended enclosure without the group, so the newcomers learn the location of fences. Only when you are satisfied the mare and foal have learned the layout and are comfortable in the sub-group, can you re-introduce the remaining group. A cohort of mares and foals will generally work well, as the presence of youngsters tends to be associated with reduced aggressive behaviour (Sigurjonsdottir and Haraldsson, 2019). Some geldings may try to drive the new mare out, so gelding companions must be chosen carefully. This is rarely the case with stallions in the case of pasture breeding.

Observe suckling behaviour

Mares that terminated suckling bouts more often than others were more likely to have foals that started abnormal repetitive behaviours before weaning (Nicol and Badnell-Waters, 2005). Foals that nuzzled the teats twice as much (19.84 vs 11.49 seconds) and spent more time suckling (37.14 vs 27.87 seconds) were more likely to develop abnormal oral behaviours (such as wood chewing and crib biting) after weaning (Nicol and Badnell-Waters, 2005). Whether these foals were hungrier, had gastric discomfort, or the mare was producing less milk, was not determined. Note that time spent suckling is not a good proxy for milk consumed (Cameron, 1998). Planning weaning carefully to minimise stress is of extra importance for these foals and will be covered in the next article.

Coprophagia is normal

Starting anytime from the first week (Francis-Smith and Wood-Gush, 1977, Crowell-Davis and Houpt, 1985a), coprophagia typically corresponds with the foal starting to graze. While it might be to ingest intestinal microflora, vitamins (Francis-Smith and Wood-Gush, 1977) or maternal pheromones (Crowell-Davis and Houpt 1985a), Marnier and Alexander (1995) postulated that it is a mechanism for learning food preferences from the dam. Crowell-Davies and Caudle (1989) tested whether foals would eat maternal faeces and/or those of another mare and found that 2 out of 6 foals tested ate faeces and only maternal faeces. This followed earlier field work where Crowell-Davis and Houpt (1985a) observed a larger cohort of foals eating mostly maternal faeces, but also sampling the faeces of others. Coprophagy has received scant scientific attention and the reasons for this natural behaviour remain unclear. As the function of coprophagia is currently unknown, it is also unknown what the impact of frequent removal of faeces on the foal's development might be.

Socialisation period

Allow access to concentrate feed, forage and safe grazing with their dams

In a study by Bolzan et al (2020), after 40 days, Criollo foals on rangeland became more selective in their grazing. Their diet shifted from widely sampling available plant life to generally eating more grasses. This continued to 110 days post-birth, where their diet shifted again to be much closer to their mothers (Bolzan et al, 2020). While the exact mechanism of selective grazing development in foals is unknown, this is the first ethological study to accurately document the progress. Crowell-Davis and Houpt (1985b) recorded almost all foal foraging as happening at the same time as the dam, when the foal would also have been closer to the dam (Crowell-Davis, 1986b). Having various suitable foods available to sample alongside the mare might provide a social enhancement effect in the foal developing adult food selection behaviour – excluding poisonous plants might promote safer, future selective grazing.

Allow access to other suitable horses of all ages

Milk enables investment in sleep, play and exploration of the physical and social environment. Feral Kaimanawa colt foals of mares in better body condition were found to play more than colts from dams in poorer condition, but the opposite was true for fillies (Cameron et al, 2008). Minimally managed, free-range Camargue colts spent

40% more time suckling in the first 8 weeks compared to fillies, and the colts were more active and spent less time grazing (Duncan et al, 1984). Playful colts resulted in mares losing bodily condition (Cameron et al, 2008), so monitor mare condition and feed as necessary. Foals that played more tended to be stronger, survive better and wean earlier than those that did not (weaning age range: colts 316 +/- 21 days, fillies 308 +/1 24 days) (Cameron et al, 2008). Carneddau colt foals received more maternal investment in terms of affiliative behaviours, presumably helping them to be highly socially skilled for their future role as stallions (Stanley and Schultz, 2012). Managing colts and fillies separately during the socialisation period and beyond may have negative consequences for the development of inter-sex social, and ultimately courtship, behaviour. Where colts and fillies are intended to breed naturally as adults, it is recommended that the sexes be kept within the same, rather than separate, social groupings, at least until puberty.

Distance between the foal and the mare gradually increases until around 9–15 weeks of age, where it plateaus for a few weeks (Crowell-Davis, 1986b). Foal-initiated distance appeared to be at least partly influenced by the sire in foals aged 2–3 months (Wolff and Hausberger, 1994). Foals of subordinate mares were involved in more affiliative interactions (Nicol and Badnell-Waters, 2005), whereas foals of higher-ranking mares stayed closer to their dams during the socialisation period (Heitor and Vicente, 2008). Foals are usually away from their dams while playing (Crowell-Davis, 1986b) and if a foal's nearest neighbour was not its dam, it was likely to be another foal (Crowell-Davis et al, 1986). Play includes running and bucking alone, play with objects, interactive contact and combative games, and play directed to an adult (Crowell-Davis et al, 1987). Adult-directed play is well tolerated by stallions in natural groups, and they will often actively play with both colt and filly foals (Šandlová et al, 2020). Colts and fillies play with equal frequency but engage in different games. Colts engage in more interactive play and play directed towards adults, whereas fillies run and buck in solo play more often – both sexes engaged in mounting play (Crowell-Davis et al, 1987). Colts' interactive play lasted longer than that for fillies, therefore it is particularly important to give colts access to suitable playmates to prevent them directing inappropriate, compensatory play to human handlers or to leave their mother as their sole playmate.

Where foals are kept within mixed age groups, the risk of transmission of infectious disease can be reduced by maintaining a closed, appropriately vaccinated group. Group members should not be taken off-site into situations where they may encounter pathogens such as strangles, because this increases the risk of transmission to the foal. Likewise, newcomers to any group with foals present should be subject to appropriate testing and a quarantine period before joining the herd.

Mutual grooming is also an important social behaviour. Jeju pony colts preferred to groom yearling fillies than their own mothers, whereas filly foals were more likely to groom with their dams (Rho et al, 2007). Grooming between foals can be equal with each sex, with colt to colt grooming often leading to combative play (Rho et al, 2007). This contrasts slightly with observations of a similar size cohort of Welsh ponies where colt foals almost exclusively groomed fillies (Crowell-Davis et al, 1986). Mutual grooming between the Welsh pony foals peaked at the age of 9–12 weeks, and fillies were generally found near other fillies (Crowell-Davis et al, 1986). The interactive play of colts and grooming directed to filly foals and to yearling fillies prepares them for life as a harem stallion, whereas fillies preferring to be nearer other fillies prepares them for life within a mostly female group.

KEY POINTS

- Foals have 4 stages of development before natural weaning: dependent period (first month), socialisation period (2nd and 3rd month), stabilising period (4th to 7th-9th month) and a pre-weaning period (8th-10th month).
- The dependent period is characterised by close proximity to the dam, frequent suckling both day and night, energetic bursts of solo play, exploratory foraging behaviour, and resting.
- The socialisation period includes rapid increases in social behaviour towards other herd members, predominantly other foals, and increasingly selective grazing similar to the dam's diet.
- It is important to provide access to pasture and a suitable social group to optimise the foal's development.
- Foals can be safely trained from three to four weeks of age alongside their dam utilising the training principles of the International Society for Equitation Science (ISES) unless specific veterinary needs require earlier intervention, in which learning theory principles should still be adhered to.

Begin training the foal

With increased social exploration comes a good opportunity to further insert the horse-human relationship into the foal's social repertoire. Foals at around 3 weeks of age often show little if any avoidance behaviour (Lansade et al, 2007), and may also approach voluntarily. Foal NZ are an exemplary organisation providing evidence-based foal training services to the Thoroughbred industry, using methods aligned to the International Society for Equitation Sciences principles of horse training (King et al, 2019). They begin when the foal is 3 weeks old, bringing mare and foal into a smaller, safely padded enclosure adjacent and visible to the home herd. A positive relationship is built with the mare and the foal is allowed to contact her at all times. Training bouts last less than 20 minutes and foals have six on average, in which they calmly learn to wear a halter, be led and to have their body handled without inducing flight or fight behaviour. This confers calm and cooperative responses anecdotally advantageous for sales entry and pre-training before ultimately racing.

Many foals enjoy being scratched, so taking time to establish where and how the foal likes to be scratched makes it possible to use scratching as a positive reinforcer (the addition of a rewarding stimulus that motivates the foal to repeat the behaviour that coincided with it) (de Andino and McDonnell, 2017). The foal slip can be fitted in stages, in combination with scratching, so the foal associates it with the pleasure of scratches and anticipates them on presentation of the foal slip and lead rope. Similarly, a rope can be placed around the foal's quarters as the foal is more likely to move forwards without panicking from forwards pressure on the quarters. Increases in rope tension should be gentle and maintained until the foal has taken a few forwards steps with the front legs before its release (Warren-Smit et al, 2005). The release should occur as the foal is moving so it functions as negative reinforcement (the removal of aversive stimulation

as a consequence of the desired behaviour, motivating the foal to repeat the behaviour in future). Adding positive reinforcement in the form of scratches to the training often promotes the foal's enjoyment of the interaction and helps to build positive relationships with humans.

Conclusions

Foals' behavioural development should be taken very seriously, as it affects the quality of life ahead of them and the safety and economic activity of the professionals involved with them. There is a growing body of evidence that can be practically applied, from exposure to safe pasture to form selective grazing habits and correct locomotor activity for optimal musculoskeletal development, to calm interaction with humans correctly aligned with the International Society for Equitation Sciences principles, and the appropriate socialisation with other horses of all ages. Advocating for all of these will serve the purpose of promoting horses fit for use by humans across the range of equestrian activity, while safeguarding the quality of life of these animals. EQ

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